RCRA and CERCLA Landfills
Air Monitoring Work Plan – Sampling and Analysis Plan
The Dalles, Oregon
Annotated Outline

1.0 Introduction

A new Work Plan – Sampling and Analysis Plan (SAP) for the additional air monitoring will be provided to EPA for approval. Where appropriate, the new Work Plan-SAP for the additional air monitoring will incorporate parts of the approved 27 August 2012 *Work Plan – Sampling and Analysis Plan for Air Monitoring, Lockheed Martin Site, The Dalles, Oregon* (ARCADIS 2012); however, the new Work Plan-SAP will be a complete, stand-alone document. The previously approved document will be referred to as the "Approved 2012 Work Plan-SAP".

1.1 Background

A brief description of the site from the Approved 2012 Work Plan-SAP will be provided.

1.2 Past Air Monitoring

Results from RCRA Landfill air monitoring before and during carbon dioxide injections will be summarized. In addition, the ambient air sampling and monitoring results at the RCRA and CERCLA Landfills in July and September 2012 will be summarized.

1.3 Gas Sampling Objectives

The objectives of the additional air monitoring include: 1) supplement the results of the September 2012 sampling event which showed no unacceptable risks to onsite or offsite workers; 2) determine if seasonal or diurnal changes impact ambient air quality at the perimeter of the RCRA landfill; 3) determine the mass fluxes (flow and concentration) of landfill gas constituents from the RCRA Landfill and the variability of that flux; and 4) collect additional data regarding the quantity and quality of ambient air and landfill gas at the RCRA Landfill and ambient air at the CERCLA Landfill and associated structures.

1.4 Data Quality Objectives

Data quality objectives (DQOs) following the seven planning steps according to EPA guidance (EPA 2006) will be provided in the new Work Plan-SAP.

1.5 Sampling Approach

RCRA Landfill: Both landfill gas quantity (flow rates) and gas quality will be measured continuously during two separate five-day time periods. During both time periods, RCRA Landfill vents 1 and 3 will be sealed and continuous gas flow and gas quality at vent 2 will be measured. High sensitivity recording pressure meters will be place on the vents 1 and 2 during this period

to assess connectivity within the gas collection layer. This approach will channel gas discharge toward vent 2, because a continuous high permeability gas collection layer is present at the top of the waste and below the HDPE liner in the landfill cap. A schematic of the monitoring setup is provided in attached Figure 1. As shown in the figure, two ultra-low flow meters (see section 4.3 for details) will be used to continuously measure gas flow both from vent 2 (outflow) and any reverse flow into vent 2 (inflow) during rising barometric pressure periods. Gas quality from vent 2 (outflow) will be continuously measured using two MX6 iBRID meters (two meters are needed to measure all required analytes – see section 4.2 for details). As shown in Figure 1, the meters will be enclosed in a sealed sample chamber (commonly referred to as a "flux" chamber). The meters will be operated in the "diffusion" mode; i.e., air will not be pumped through the meter (sample "draw" mode). In the diffusion mode, the concentrations of the analytes are measured in the air that is in contact with the meter sensors. During the two monitoring periods, "instantaneous" field air quality measurement will also be performed at the RCRA landfill within one foot and downwind of vent 2 (outflow from the flow meter), in the downwind breathing zone at vent 2, the landfill perimeter, the leachate sump, utility building and six cap drain pipes. At selected locations, extractive laboratory samples will also be collected. In addition, continuous air quality monitoring will also be performed within one foot and downwind of vent 2 and at the RCRA landfill perimeter berm during each of the five-day periods. At each location, two MX6 iBRID meters will be used to measure the analytes. The perimeter locations will be selected based on the instantaneous measurements and will be moved each day to monitor different locations along the perimeter berm, including locations near the top of the berm near the limit of the HDPE liner. The perimeter berm samples will be collected for 24 hour periods at several locations on the landfill surface, with the probe intake located at or slightly below the surface of the rip-rap cover to provide concentration data from the perimeter berm area that is less subject to dispersion by wind.

CERCLA Landfill: During the two monitoring periods discussed above, ambient air at the CERCLA Landfill perimeter will be monitored with field meters and sampled for laboratory analyses. In addition, ambient air inside the manholes and the lift stations, in the breathing zones above the manholes and lift stations, the nutrient tank shack, leachate sump, and the leachate tank will be monitored with field meters. At selected locations, extractive laboratory samples will also be collected.

2.0 Sampling Locations and Frequency

Proposed sampling locations will be similar to those provided in the Approved 2012 Work Plan-SAP. The new figures with any modifications will be provided in the new Work Plan-SAP. A summary of the sampling locations and frequency is provided in attached Table 1.

2.1 RCRA Landfill

Locations: landfill perimeter ambient air (10 locations, approximately every 200 feet, continuous monitoring in the sample "draw" mode between stations); continuous air quality at various location on the perimeter berm at or slightly below the surface of the rip-rap; continuous landfill

gas flow and quality at vent 2 with the other two vents closed; continuous air quality adjacent to vent 2; leachate sump; utility building; six cap drain pipes.

2.1.1 Field Monitoring

Flow: continuous flow monitoring at vent 2 (both inflow and outflow) for two five-day periods.

Pressure: pressure in vents 1 and 3 will be continuously monitored during the sampling events.

Continuous Quality: continuous quality monitoring at vent 2 (outflow with meters in the diffusion mode) for two five-day periods; continuous quality monitoring downwind of vent 2 for two five-day periods; continuous quality monitoring at various locations on the perimeter berm for two five-day periods

Instantaneous Quality: three "instantaneous" sampling events at all locations given above during each five-day sampling period for a total of six events.

2.1.2 Extractive Sampling for Laboratory Analyses

One "instantaneous" collection event during each five day period for a total of two events.

2.2 CERCLA Landfill

Locations: Landfill perimeter ambient air (19 locations, approximately every 200 feet, with continuous monitoring in the sample "draw" mode between stations); inside manholes; outside manholes in the breathing zone; inside lift stations; outside lift stations in the breathing zone; nutrient tank shack breathing space; leachate sump; leachate tank.

2.2.1 Field Monitoring

Instantaneous Quality: two "instantaneous" sampling events at all locations given above during each five-day period for a total of four events.

2.2.2 Extractive Sampling for Laboratory Analyses

One "instantaneous" collection event during each five-day period for a total of two events.

3.0 Sampling Analytes and Measurement/Analytical Methods

3.1 Field Analytes and Measurement Methods

The following analytes will be measured in the field: acetylene, ammonia, carbon dioxide, hydrogen fluoride, hydrogen, hydrogen cyanide, hydrogen sulfide, methane, oxygen, phosphine and lower explosive limit (LEL). Table 2 provides the analyte, method, collection media, holding time, MRL (method reporting limit), measuring range, industrial worker ambient air screening level and short-term air screening level. Modifications from the 2012 Approved Work Plan-SAP include:

- Only the MX6 iBRID Multi-Gas meter will be used (the RIK Eagle 2 meter will not be used). Overall, the MX6 iBRID has similar detection limits for the parameters that were previously measured by the RIK Eagle meter. Two MX6 iBRID meters will be used to cover the list of analytes.

- Acetylene will be measured using a Sensidyne colorimetric tube. The MX6 iBRID and the RIK Eagle 2 meters cannot quantitatively measure acetylene (the MX6 iBRID can provide an indication that acetylene is present).
- The reporting limits have been modified as necessary based on use of the MX6 iBRID and colorimetric tubes.
- The measuring range for the analytes has been added to Table 2.

3.2 Laboratory Analytes and Analytical Methods

Extractive air samples will be collected in the field and sent to laboratories for analyses. The following analytes will be analyzed at laboratories: acetylene, ammonia, carbon dioxide, hydrogen fluoride, hydrogen, hydrogen cyanide, hydrogen sulfide, methane, oxygen and phosphine. Table 3 provides the analyte, method, collection media/container, holding time, DL (detection limit)/MRL, sampling times, industrial worker ambient air screening level and short-term air screening level. Modifications from the 2012 Approved Work Plan-SAP include:

- Silonite-coated Summa canisters will be used for collection of samples for analysis of acetylene, carbon dioxide, hydrogen, hydrogen sulfide, methane and oxygen. Tedlar bags will not be used.
- Hydrogen sulfide will only be analyzed using samples collected in the summa canisters. The adsorbent tube method will not be used.
- Detection limits have been adjusted based on the laboratory results from the September 2012 sampling.
- The sampling times for the summa canisters, adsorbent tubes and filter media have been added to Table 3.

4.0 Field Sampling and Monitoring Activities

4.1 Field Monitoring Instruments (analyte measurements)

As provided in Table 2, the MX6 iBRID Multi-Gas meter will be used to measure ammonia, carbon dioxide, hydrogen, hydrogen cyanide, hydrogen sulfide, methane, oxygen, phosphine and LEL. Sensidyne colorimetric tubes will be used to measure acetylene and hydrogen fluoride.

4.2 Sampling Methods

Two types of field sampling will be performed using the MX6 iBRID meter: 1) “continuous” sampling and analyses at RCRA Landfill vent 2 outflow, downwind of vent 2, and various locations on the surface of the RCRA landfill berm and 2) “instantaneous or grab” samples at other locations (see Section 2). The continuous sampling will be performed in the diffusion mode for the monitoring of the outflow at vent 2 (meters in the flux chamber). The other continuous monitoring (downwind of vent 2 and RCRA landfill perimeter berm) and instantaneous/grab sampling will be performed in the sample “draw mode”; i.e., the SP6 motorized sampling pump will be attached to the MX6 iBRID meter. The SP6 pump collects air at a rate of 0.3 to 0.5 L/minute. Analyses will be conducted and recorded by the MX6 meter at 60 second intervals for continuous analyses at RCRA Landfill vent 2, downwind of vent 2 and the

RCRA landfill perimeter berm. At the "grab" sample locations, sampling will be performed and measurements recorded at 10 second intervals for one minute. Depending upon the variability of the measurements, sampling and analyses may continue until measurements are relatively stable.

For the sampling at the CERCLA Landfill inside the manholes and lift stations, a tube will be extended through the manhole cover approximately 10 feet below the surface elevation. All meters and air sample collection containers will be on the surface.
For the Sensidyne colorimetric tubes, one pump stroke with orifice (3 minutes) will be used for acetylene and six pump strokes (without orifice, 6 minute) will be used for hydrogen fluoride.

4.3 Field Flow Measurements

During flow monitoring from RCRA Landfill vent 2, Ritter MilliGascounter type MGC-1 flow meters will be used to measure gas flow rates. The MilliGascounter can measure flow rates between 1 mL/hr and 1 L/hr. Two meters will be used in parallel with check valves to measure flow from vent 2 (outflow) and any reverse flow into vent 2 (inflow), see Figure 1. Two meters are necessary because the MilliGascounter can only measure flow in one direction.

4.4 Field Instrument Calibration

The MX6 iBRID Multi-Gas meter will be calibrated according to manufacturer instructions using appropriate calibration gases.

4.5 Onsite Weather Monitoring

Meteorological data will be obtained from an onsite recording station during the monitoring program. Meteorological parameters recorded will include wind speed and direction, barometric pressure, and temperature. A wind sock will also be placed to allow assessment of wind direction during perimeter sampling episodes. Instantaneous sampling with field meters and extractive sample collection will be performed during the daily barometric low pressure occurrence. Initial data from continuous monitoring will be assessed to determine gas discharge trends and their relationship to barometric pressure changes to determine if any changes to the perimeter sampling protocol are indicated.

4.6 Field Sampling Personnel

The roles and qualifications of all field staff will be provided.

5.0 Extractive Sampling

5.1 Sampling Methods and Locations

The sampling methods for the extractive samples are provided in Table 3. For the sorbent tubes and treated filter (phosphine), a personal sampling pump will be used to pump the samples through the collection media. The sampling times (ranging from 3 to 6 hours) and flow rates (ranging from 200 to 1,000 mL/minute) are provided in Table 3. For samples collected into the

Summa canisters, the flow valves will be installed at the laboratory to sample air over a 7 hour period.

For the sampling at the CERCLA Landfill inside the manholes and lift stations, a tube will be extended through the manhole cover approximately 10 feet below the surface elevation. All sampling pumps and air sample collection containers/media will be on the surface.

The anticipated extractive sampling locations and total number of laboratory samples are provided on Table 4. As shown, extractive sampling is anticipated to occur at 15 locations. The exact locations and number of locations will depend upon the field measurements.

5.2 Laboratories

Analysis for acetylene, ammonia, carbon dioxide, hydrogen, hydrogen sulfide, methane and oxygen will be performed by ALS Environmental in Simi Valley, California. Analyses for hydrogen cyanide, hydrogen fluoride and phosphine will be performed by ALS Environmental in Salt Lake City Utah.

6.0 Quality Assurance and Quality Control

6.1 Field Instruments

Available precision and accuracy statements from the instrument manual will be summarized.

6.2 Laboratory Methods

Available precision and accuracy statement from ALS Environmental's QAPP will be summarized.

6.3 Field QA/QC Samples

A summary of the field/trip blanks and duplicate samples is provided in Table 4.

6.4 Laboratory QA/QC Samples

A summary of the laboratory QA/QC samples will be summarized from ALS Environmental's QAPP.

7.0 Reporting and Interpretation of Results

7.1 Comparison to Screening Levels

The measured concentrations will be compared to the screening levels provided in Tables 2 and 3.

7.2 Comparison to Past Sampling Results

The results of the proposed sampling program will be compared to previous sampling results (e.g., October 26, 2012 report).

7.3 Calculations of Mass Flux of Contaminants from the RCRA Landfill

The continuous flow measurements and analyte concentrations will be used to calculate the mass flux (mass per hour) from RCRA Landfill vent 2.

7.4 Conclusions and Recommendations

The overall conclusions concerning each objectives stated in Section 1.3 will be summarized. If appropriate, recommendation for additional sampling or other actions will be provided.

Additional Work Plan-SAP Figures to be provided: RCRA Landfill Sample Locations; CERCLA Landfill Sample Locations

Table 1 - Sampling Locations and Frequencies

Sampling Location	Type of Sampling	Sampling Frequency
Landfill Perimeters	Field Meters and Laboratory Samples	RCRA Landfill field meters: instantaneous samples 6 times (three times during each 5-day sampling period); continuous samples of the surface of the RCRA landfill perimeter berm at various locations during each of the 5-day sampling periods. CERCLA Landfill field meters: instantaneous samples 4 times (two times during each 5-day sampling period). RCRA and CERCLA Landfill lab samples: 2 times (one time during each 5-day sampling period).
RCRA Landfill Vents (vents 1 and 3 closed; monitor vent 2)	Field Meters (flow and analytical) and Laboratory Samples	Continuous flow and continuous field meters (two 5-day periods) of the outflow from vent 2. Pressure will be continuously monitored at vents 1 and 3 during the sampling period. Field meters: continuous downwind samples one foot from vent 2 outflow; continuous samples of the outflow from vent 2 (flux chambers) and instantaneous monitoring of the breathing zone near vent 2 (six events). Lab Samples: two sample events (one time during each 5-day sampling period).
RCRA Sump; RCRA Utility Bldg; RCRA cap drain pipes; inside CERCLA manholes; inside CERCLA lift stations; breathing zone at CERCLA manholes; breathing zone at CERCLA lift stations; Nutrient Tank Shack breathing zone; CERCLA Leachate Sump; CERCLA Tank	Field Meters and Laboratory Samples	RCRA Landfill field meters: instantaneous samples 6 times (three times during each 5-day sampling period). CERCLA Landfill field meters: instantaneous samples 4 times (two times during each 5-day sampling period). RCRA and CERCLA Landfill lab samples: 2 times (one time during each 5-day sampling period).